§103

Claims 16-18 and 25 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,940,181 to Juskey, Jr. et al. and U.S. Patent No. 5,773,359 to Mitchell et al.

Claim 19 is rejected under 35 U.S.C. §103(a) as being unpatentable over Juskey, Jr. et al. in view of Japan No. 4-65130 to Okuyama.

These rejections are respectfully traversed.

Patentability

First, it should be noted that although the Office Action in many places in discussing Juskey and Mitchell refers to "ball", the term "ball" does not occur anywhere throughout the entirety disclosure of Juskey or Mitchell. Juskey and Mitchell only disclose and refer to metal bumps. The present invention is directed to spherical metal balls having a diameter of not greater 150 micrometers. See independent claims 16 and 17.

The Office Action seems to misread the "bump" in Juskey and Mitchell as a "ball". For example, although the Office Action has referred to column 3, line 33-39 and Figs. 3-4 of Juskey, and has stated that Juskey describes the metal balls 30 being adhesively bonded to the respective electrodes, being reflowed, and being physically attached to tops of the electrodes 18, 20 and 22, the member identified by reference numeral 30 in the cited passage of Juskey is identified as a "bump". Also, column 3, lines 31-37 of Mitchell cited by the Office Action explicitly indicates the member 29 is a "bump" and not a spherical ball. Likewise, column 5, lines 33-35 of Mitchell, cited by the Office Action, only refers to an interconnect "bump".

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The Office Action states at page 2 that Mitchell is relied upon for disclosing the feature of spherical solder balls. Applicants maintain that Mitchell does not disclose, suggest or refer to spherical metal balls.

Column 3, lines 31-37 of Mitchell clearly refers to interconnect "bump" 29. Column 3, line 38 of Mitchell refers to the electroplating process of step 15. With reference to Fig. 1 of Mitchell, block 15 (or step 15) is labeled "Providing An Interconnect Bump Over The Under Bump Metallurgy".

As such, the Office Action incorrectly understands that the bumps in Juskey and Mitchell are the same as the balls in the invention of the present application. However, the invention of the present application relates to a process for producing a semiconductor device provided with spherical metal balls adhesive bonded to electrodes (see independent claims 16 and 17), and does not relate to a process for making bumps on a semiconductor device. The process of the present application provides metal balls and not bumps. The metal balls are converted into bumps by a subsequent process which does not form part of the claims.

Before the invention of the present application, bumps on a semiconductor device were formed by a process such as plating, evaporation or printing. A technique of forming bumps using minute metal balls having a diameter of about 100 micrometers was not known prior to the present invention. Juskey as well as Mitchell do not disclose or suggest the use of metal balls for the formation of their bumps.

In contrast, the inventors of the present application developed the claimed processes of the present invention wherein metal balls having a diameter of not greater than 150 micrometers are bonded to electrodes of a semiconductor device using flux as an

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adhesive. This unique process could not have occurred to a person with ordinary skill in the art even if he considered Juskey with Mitchell.

It is therefore submitted that independent claims 16 and 17 are patentable Juskey and Mitchell standing alone or in combination.

Since independent claims 16 and 17 are patentable, dependent claims 18 19 and 25 are also patentable.

CONCLUSION

It is submitted that in view of the foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application be allowed and passed for issue.

Respectfully submitted,

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